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(54) CANNING PROCESS

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BACKGROUND OF THE INVENTION

This invention relates to an improved process for the production and preservation of certain types of foods and combinations of foods in hermetically sealed containers, such as cans, jars, flexible packaging, etc., commonly referred to as canning. More particularly, the invention relates to a process of canning normally low or medium acid foods and combinations of such foods, including meat, poultry, fish, seafoods, cheese, vegetables and cereal products, under conditions which provide a commercially sterile product but which do not significantly alter the textural properties of the food.

Canned foods which are commercially available, generally are heat processed to prevent microbiological spoilage so that the canned product, at room temperature, will remain unspoiled indefinitely from a microbiological standpoint. Such canned foods are heat processed to render the product "commercially sterile", which term is defined to mean that condition in which all Clostridium botulinum spores and all other pathogenic bacteria have been destroyed, as well as more heat resistant organisms, which, if present, could produce spoilage under normal conditions of storage and distribution.

It is well known that commercial sterility of canned foods is affected not only by heat treatment but also by the pH of the product. Thus it is well recognized that foods with a pH of 4.5 or less may be heat processed under relatively mild conditions to provide a commercially sterile canned product. Foods such as tomatoes, pears, figs, pineapple and peaches, which have a pH of between 4.5 and 3.7, are referred to as acid foods. Foods such as berries, apples, citrus fruits, sauerkraut and pickles, which have a pH of 3.7 and lower, are generally referred

to as high acid foods. In practically all cases, acid-tolerant organisms can be destroyed by subjecting acid or high acid foods to a short heat process at about 212°F.

However, while the growth of some microorganisms, such as Clostridium botulinum, is inhibited in foods having a pH of 4.5 or less, such microorganisms are a potential health hazard in foods having a normal pH range of above 4.5. Such foods include meats, poultry, fish, seafood, milk, corn, lima beans, potatoes, spaghetti, spinach, and olives which have a pH of 5.3 and higher (generally referred to as low acid foods), and foods such as asparagus, carrots, green beans, cabbage, pasta, bananas and pumpkin which have a pH of between 5.3 and 4.5 (generally referred to as medium acid foods). Such low acid and medium acid foods require high processing temperatures, that is, about 240°F., for prolonged periods of time in order to assure adequate destruction of the spores of food spoilage organisms. Thus, Bulletins 26-L (10th Edition, 1966) and 30-L (4th Edition, 1971) of the National Canners Association specify process times for many foods in metal and glass containers respectively at several retort temperatures and for several container sizes. For example, the following process times are specified for foods having an initial temperature of between 130°F.-170°F. in metal containers (307 x 409) and glass containers (303 x 411).

Product	Minutes at 240°F.	
	Metal Container	Glass Container
Beans, lima	35	45
Beans, green	20	25
Beans, with pork, in sauce	95	100
Carrots	30	30
Corn, whole kernel	50	50
Peas	35	45
Potatoes, sliced	30	40

As a result of such extended high-temperature heat treatment, the colour, texture, and flavour of the products are adversely affected. Consequently, most conventional, canned, low and medium acid foods are inferior in colour, texture, and taste to fresh-cooked products. Moreover, such extended high temperature heat processing has been found to have an adverse affect on the nutritional value of foods.

It is believed that such undesirable changes in low and medium acid foods upon extended heat processing at high temperatures are due to several factors. Thus, retorting geletinizes the starch contained in foods and causes partial breakdown of the microstructures of the starch masses and even some hydrolysis of the molecules. As a result, foods containing substantial amounts of starch, such as peas, beans, and potatoes, lose part of their structural identify and become undesirably soft and mushy. Also, the selective permeability of the cell membranes is destroyed by prolonged high temperature processing so that crispness and similar textural properties of the food no longer exits. Moreover, such extended high-temperature heat processing causes the partial decomposition of labile compounds, such as vitamins, flavour components, colours, and the like.

A number of alternative techniques have been suggested heretofor in an attempt to produce sterile low acid and medium acid foods in containers. However, such prior techniques are subject to a number of disadvantages which have limited their use in commercial operations. For example, it has been suggested that foods be sterilized prior to being placed in containers by passing the food through a high-temperature heat exchanger where the food is subjected to

very high temperatures for a short period of time and is then aseptically filled into containers. However, the problems encountered in manipulating and filling some types of foods (such as, for example, asparagus), and the inability to pump other types of food products through heat exchangers due to their physical consistency and particulate nature, are reasons why most canned foods are still sterilized in the container after packaging.

SUMMARY OF THE INVENTION

The present invention provides a process of producing sterile canned foods which are not subject to the disadvantages discussed above. As used herein, the terms "sterile" and "sterilized" mean "commercially sterile" as that term is defined hereinabove. The invention is concerned with the canning of normally low acid and/or medium acid foods, that is, foods which in their natural state have a pH of above 4.5, including meat, poultry, fish, seafoods, cheese, vegetables and cereal products, for it enables such foods to be canned under conditions which do not significantly adversely affect the texture, taste, appearance, or nutritional value of the food. Consequently the product produced by the present process is commercially sterile but is significantly superior in texture, taste, appearance, and nutritional value to products prepared by prior art techniques.

According to the present invention, uncooked, partially cooked or fully cooked meat, poultry, fish and/or seafood particles, in the form of slices, cubes, shreds, etc., are acidified, such as by marination in an aqueous acidic solution having a temperature up to about 160°F., for a period of time sufficient to reduce the overall pH of the particles

to 4.5 or below. As used herein, the overall pH of the food refers to the pH obtained by measuring the pH of the food in comminuted form. Also, it is to be understood that references herein to meat shall include poultry, fish and/or seafood products as well as meat products and combinations thereof. Other normally low acid or medium acid foods which are to be combined with the meat particles, such as vegetables and cereal products, are subjected to an acid blanch at a relatively high temperature for a short period of time to reduce its overall pH to below about 5.0. The acidified meat particles and the acid blanched non-meat food particles are combined in a suitable container with a hot acidic liquid phase, such as a sauce, gravy, dressing, etc., having a temperature of about 180°F. - 212°F. and a pH of below 4.5 so that the liquid phase completely surrounds all the food particles. The containers are then sealed, inverted and cooled to thereby provide a product which is commercially sterile. Due to the acid blanching of the normally low or medium acid foods and the fact that they are submerged in the hot acidic liquid phase, the normally low or medium acid food particles in the container have an overall pH of 4.5 or below within about 30 minutes after the food particles and the liquid phase are combined. The sealed containers require no additional heat processing to provide a commercially sterile product, particularly when the overall pH of the particles in the containers is 3.7 or below, and/or the particles and the liquid phase are at a temperature above about 185°F. when filled into the containers. If desired, the sealed containers may be subjected to minimal additional heat processing in order to insure the commercial sterility of the product, particularly when the overall pH of the particles in the containers is above 3.7. As a result, the

taste, texture, appearance and nutritional value of the meat and the normally low or medium acid foods are preserved.

DESCRIPTION OF PREFERRED EMBODIMENTS

In preparing the canned product of the present invention, slices, cubes, shreds or other particle shapes of uncooked, partially cooked or fully cooked meat, poultry, fish and/or seafoods are contacted with an aqueous acidic solution so that the acidic solution permeates the meat, poultry, fish, or seafood particles (hereinafter generally referred to as meat particles) to reduce the overall pH of the particles to at least 4.5; that is, to 4.5 or below. The reduction in pH of the meat particles to 4.5 or below is a function of many factors, such as the type of meat, moisture content of the meat, density or porosity of the meat, total surface area of the meat, distance from the surface to the center of the particle, the temperature and pH of the acidic solution and the manner in which the meat particles are contacted with the acidic solution. Accordingly, it is difficult to ascribe an exact range of conditions under which this pH reduction of the meat particles may be carried out. In general, the acidic solution has a temperature in the range of about 32°F. to 160°F., preferably between about 125°F. to 145°F., and a pH of between about 2.5 and 3.5. Temperatures above about 160°F. have been found to result in deterioration of the texture of some types of meat and are generally not preferred for use in the process.

Any acid, organic or inorganic, which is suitable for use in conjunction with foods, may be used in the acidic marinating solution, such as, for example, acetic, citric, malic, hydrochloric, lactic, phosphoric and tartaric acids, and the like, and combinations thereof. Acetic and malic acids have been

found to be particularly well suited for use in the acidic marinating solution.

Preferably, the cooked meat is cut, chopped, etc. into slices, cubes, shreds or other particle shapes not exceeding about 1 to 1-1/4 inch in thickness. Thus, in order to facilitate pH reduction of the meat the distance from the surface to the center of the particles should not exceed 5/8 inch. Generally, the meat particles are immersed in the acidic solution. Other techniques for contacting the meat particles with the acidic solution may of course be used. For example, the acidic solution containing the meat particles may be subjected to a vacuum so that upon release of the vacuum the acidic solution will be rapidly infused throughout the meat particles. Also, meat may be comminuted while in contact with the acidic solution, packed in a suitable casing and heated to set the meat in the form of an acidified loaf, from which particles may be cut for use in preparing the product of this invention. The amount of acidic solution contacted with the meat particles may vary widely. For example, ratios of 2 to 10 or more parts by weight of acidic solution per one part by weight of meat particles is effective in rapidly reducing the overall pH of the meat to 4.5 or below.

Within the parameters given above, the period of time the meat particles are maintained in contact with the acidic solution is primarily dependent upon the type of meat used. For example, under the conditions set out above, seafoods such as shredded crabmeat are maintained in contact with the acidic solution for 8 to 10 minutes to reduce their overall pH to 4.5 or below, while a contact time of about two hours is required to reduce the overall pH of certain meats, meat products and poultry, such as one-half inch cubes of ham, beef, salami,

chicken and turkey. It is to be understood that within the above parameters the meat particles are to be maintained in contact with the acidic solution for a period of time sufficient to reduce the overall pH of the meat to 4.5 or below.

When the desired pH is attained, the meat is removed from the acidic solution and filled into containers. Preferable, the acidified meat particles are at a temperature of about 140°F. - 160°F. when filled into the containers. If the particles are acidified at a lower temperature, or are held in storage after acidification, they should be heated to a temperature within this range, such as by steaming for a short period of time, prior to filling into the containers.

The acidified meat particles are combined in the container with normally low acid or medium acid non-meat foods, such as fruits, vegetables, and cereal products, such as pasta and pasta products, which have been subjected to a hot acid blanch for a relatively short period of time in order to reduce the overall pH thereof to about 5.0 or below. The reduction in the overall pH of the normally low and medium acid foods to 5.0 or below is effected by contacting the normally low acid or medium acid food in particulate form, with an acidic aqueous medium at a relatively high temperature for a short period of time. This blanching can be accomplished by any suitable technique which provides adequate contact between the food particle and the hot acidic medium so that the time required to reduce the overall pH of the food particles to 5.0 or below is minimized. Suitable procedures include, for example, submerging the food pieces in a hot acid solution, drenching the food pieces with a hot acid solution, and other suitable techniques.

Since the reduction in overall pH of the normally low

and medium acid food particles to about 5.0 or below is a function of time, temperature, pH, and particle size of the food, it is difficult to ascribe an exact range of conditions under which this blanching procedure can be practiced. In general, the temperature of the hot acid solution is in the range of about 180°F and 212°F, the pH of the acid solution is preferably between about 2.5 and 3.5, and the time of contact between the food particles and the hot acid solution is on the order of about 1 to 15 minutes. The non-meat food particles preferably have a thickness of no more than about one-half inch. Obviously, piece size and shape, the amount of agitation or rapidity of circulation of the hot acid solution and other factors will affect the rapidity of reduction in pH of the food. The important process limitation is that the overall pH of the normally low acid or medium acid food is rapidly reduced to about 5.0 or below without significantly adversely affecting the flavour and textural characteristics of the food.

Any of the acids disclosed hereinabove which are suitable for use in conjunction with foods may be used in the blanching solution. Generally, it is preferred to use malic acid in the blanching solution, for it is particularly suitable in reducing the overall pH of normally low or medium acid food particles to 5.0 or below in a short period of time without adversely affecting the taste, texture, appearance or nutrition of the food particles.

The amount of hot acidic blanching solution contacted with the food particles may vary widely. For example, ratios of 2.5 to 10 parts or more by weight of blanching solution per one part by weight of food particles have been found to be effective in rapidly reducing the overall pH of normally low and medium

acid foods to 5.0 or below. It will be understood that ratios outside this range may be used as long as there is sufficient contact between the food particles and the blanching solution to effect rapid reduction in the overall pH of the food.

Contacting the food particles with the hot acid blanching solution in the manner described above not only effects the reduction of pH of the food, but also serves to substantially inactivate some enzymes in the foods to thereby prevent enzymatic reactions which could lead to changes in colour, flavour or texture during subsequent holding or processing steps. Moreover, contacting the food particles with the hot blanching solution also serves to heat the food rapidly for subsequent processing.

When the overall pH of the normally low or medium acid food particles has been reduced to 5.0 or below, the food particles are removed from the hot acid blanching solution, drained and rapidly combined in containers with the acidified meat particles. Filling of the acid blanched food particles into the containers should be accomplished as quickly as possible, that is, within about 1 - 5 minutes, after the particles are removed from the hot blanching solution so that the particles will be at a temperature of about 150°F. to 210°F. when they are introduced into the container. Such rapid filling of the acid blanched food particles facilitates the retention of the original taste, texture and appearance of the particles.

In addition to the acidified meat particles and the acid blanched food particles, a hot acidic liquid phase having a pH of 4.5 or below is also introduced into the containers in an amount sufficient that the acidic liquid phase surrounds the meat particles and food particles in the container. This acidic liquid phase may or may not contain suitable condiments. When

filled into the containers, the liquid phase is at a temperature of about 180°F. - 212°F., preferably between about 200°F. - 210°F. The pH of the liquid phase is sufficient to not only inhibit the growth of microorganisms in the liquid phase but to also reduce the overall pH of the acid blanched food particles to 4.5 or below within a short time after the food particles are combined with the liquid phase.

The nature of the acidic liquid phase will, of course, depend upon the type of product desired. Preferably condiments, such as seasoning, spices, and the like are included in the acidic liquid phase. Thus, the liquid phase may be in the form of a sauce, gravy, dressing, and the like. The important characteristics of the liquid phase are that it have a pH of 4.5 or below, preferably between about 2.5 and 4.0, have a taste which is compatible with an acid pH, and be a flowable liquid so that it surrounds all the particulate matter in the container and is in contact with all portions of the container walls. According to one embodiment of the invention, the acidic liquid phase contains gel forming ingredients so that while it is initially introduced into the container as a liquid, upon cooling it solidifies into a gel which surrounds all the food particles in the container. The desired degree of acidity may be provided in the liquid phase by the inclusion therein of any acid which is suitable for use in food processing, including natural acids such as tartaric acid and acid fruit juices; fermentation acids such as vinegar, lactic acid, citric acid and fumaric acid; and synthetic acids, both organic and inorganic, such as malic acid, phosphoric acid, adipic acid and the like. The ratio of acidic liquid phase to particulate matter filled into the containers must be such that the liquid phase surrounds all the particulate matter in the container.

The order in which the acidified meat particles, blanched food particles and liquid phase are introduced into containers is of no particular significance as long as once in the container the liquid phase surrounds the particles and is in contact with the entire surface of the inner walls of the container. Thus, the meat particles and food particles may be combined and then filled into the container or they may be separately filled into the container. Similarly, the liquid phase may be combined with either the meat particles and/or food particles before or after the particles are filled into the containers. According to a preferred embodiment, a portion of the liquid phase is introduced into the containers prior to any of the particles to insure complete contact of the liquid phase with the walls of the container, the acidified meat particles and blanched food particles are then filled into the containers, after which the remainder of the liquid phase is introduced.

After the acidified meat particles, blanched food particles and liquid phase are filled in the container, the container is sealed and inverted to ensure contact of the hot liquid phase with all inner surfaces of the container. The sealed containers, which have a center can temperature of about 150°F. - 210°F. may require no additional heat processing to provide a commercially sterile product, particularly when the overall pH of the particles in the containers is 3.7 or below, and/or the particles and the liquid phase are at a temperature above about 185°F. when filled into the containers. If desired, the sealed containers may be subjected to minimal additional heat processing, such as by heating the product in the containers to 185°F. for 3 min. or for equivalent time-temperature relationships, in order to insure the commercial sterility of

the product, particularly when the overall pH of the product in the containers is above 3.7. The containers may be cooled if desired such as by water quenching to a center can temperature of about 100°F. - 120°F. Generally, it is preferred to so cool the containers to maintain the quality of the product.

If desired, fruits and/or vegetables which normally have a pH of 4.5 or below, such as tomatoes, apples, oranges, peaches, pineapple, etc., may also be filled into the container. Such normally acidic foods are cut into slices or cubes and heated until the particle has a center temperature of at least 160°F. and are then introduced into the container. The order in which such normally acidic food particles are filled into the container is of no particular consequence as long as the acidic liquid phase also surrounds these particles.

Since high temperature heat sterilization of the canned product is not required, the meat and blanched food particles substantially retain their flavour, and textural characteristics. Moreover, containers of minimum strength may be used for holding the product, thereby allowing greater manufacturing flexibility, utilizing a variety of packaging materials,

The following examples are given in order to illustrate but not to limit the present inventions. All parts and percentages set forth herein are by weight unless otherwise indicated.

EXAMPLE I

A salad comprising vegetables and salami in Italian dressing is prepared in the following manner:

Liquid Phase - Italian Dressing

Ingredients	Percent by Weight
Water	64.8
Cottonseed Oil	19.8
Relish	7.0
Sugar	4.2
Salt	2.8

Lemon Juice	0.9
Malic Acid	0.2
Italian Spices	0.2
Garlic Oil	0.1
	100.0

The salad dressing is prepared by mixing the water and cottonseed oil to form a slurry, and adding the other ingredients, with mixing, to the slurry. The salad dressing thus formed has a pH of about 2.5 and is heated, with agitation, to about 200°F.

Meat Particles

An aqueous acidic solution containing 23.5% water, 35.3% vinegar (100 grain) and 41.2% sugar is prepared and heated to boiling. The resulting solution, which has a pH of about 2.4, is then cooled to room temperature. A quantity of salami is cut into strips about 1" x 1/2" x 1/4" in size and immersed in the aqueous acidic solution for approximately 2 hours, at which time the overall pH of the salami is about 4.1. The salami strips are then removed from the acidic solution and heated, by steaming, to a temperature of about 150°F.

Vegetable and Cereal Particles

Fresh celery (pH of about 5.6 - 6.2), fresh onion (pH of about 5.2 - 5.6), garbanzo beans (pH of about 5.8 - 6.3), and macaroni (pH of about 5.5 - 6.0) are used as the normally low acid and medium acid foods. The celery is cut into 1/4" slices, and the onions are cut into 1/4" slices and then quartered. The vegetables are then subjected to a hot acid blanch by mixing the vegetable with a malic acid solution having a pH of 2.85 and a temperature of 190°F. - 210°F. in a continuous steam Blancher/cooker for a period of 3 minutes. The macaroni is subjected to a hot acid blanch with the hot malic acid solution for 15 minutes. At the end of the hot acid blanch, the vegetables and macaroni all have a pH of below 5.0.

The acid blanched vegetables and macaroni are mixed with the acidified salami and combined with tomatoes and acidified olives, both of which have a pH of below 4.5, for filling into containers within 5 minutes after the acid blanched foods are removed from the hot blanching solution, the mixture of particulate material being:

Ingredients	Percents by Weight
Tomatoes	29.0
Salami	21.0
Macaroni	21.0
Celery	19.0
Garbanzo Beans	5.0
Olives	2.5
Onion	2.5
	100.0

In the filling operation, a small amount of the liquid salad dressing is first introduced into the containers to coat the walls of the containers, the mixture of particulate material is then added, after which the remainder of the salad dressing is filled into the containers. The filled containers, having about 67% by weight particulate material and 33% by weight salad dressing, are then sealed, inverted and heated at 210°F. - 212°F for about 5 minutes whereby the product in the containers is heated to about 185°F.- 190°F. for 3 minutes, after which the containers are quenched with cool water to reduce the internal temperature of the cans to about 120°F. The resulting product is commercially sterile. The meat, vegetables and cereal in the product retain substantially their original taste, texture and appearance. Salads containing poultry, fish, seafood or other meat particles may be prepared in the same manner.

Similar results are obtained when other acids used in food processing, such as acetic, lactic, citric, phosphoric and the like are used to acidify the meat, vegetables and/or cereals.

As noted hereinabove, a commercially sterile product may be produced by the present invention with no additional heat processing of the filled, sealed containers. Thus, when the acidified meat, acid blanched vegetables and macaroni and the liquid salad dressing of Example I are filled into containers at a temperature of about 185°F. - 195°F., and the containers are sealed, inverted, and cooled, a commercially sterile product is obtained without additional heat processing of the filled sealed containers. Similarly when the overall pH of the food particles in the sealed containers is 3.7 or below, no additional heat processing of the sealed containers is required to provide a commercially sterile product.

EXAMPLE II

A gelled salad containing meat, fruits and vegetables is prepared according to the present invention, the salad having the following formulation:

Ingredients	Percent by Weight
Water	27.8
Crushed Pineapple	29.8
Ham	12.0
Sugar	12.0
Celery	5.0
Orange Peel	2.0
Cherries	3.0
Lemon Juice	5.0
Almonds	1.0
Cottonseed Oil	1.0
Pectin	0.7
Gelatin	0.2
CaCl2	0.1
Emulsifier	0.1
Flavouring	0.3
	100.0

In preparing this gelled salad product, the ham is cut into cubes approximately 3/8" in size and immersed in an acidic aqueous solution of water, vinegar and sugar of Example 1 at room temperature (70°F. - 72°F.) for 2 - 2.5 hours, at which time the

overall pH of the meat particles is about 4.1 - 4.3. The ham particles are then steamed (212°F.) for a time sufficient to raise the temperature of the meat to about 150°F.

Celery, cut into cubes about 1/4" - 3/8" in size, and almonds, are subjected to a hot acid blanch in an aqueous malic acid solution having a pH of 2.85 for 3 minutes at 210°F. to reduce their overall pH to below 5.0. The cherries are subjected to steaming (212°F.) to raise their temperature to about 140°F - 160°F.

The gel portion of the salad is prepared by adding orange peel to a solution of water and sugar, heating the mixture to boiling and then cooking the mixture at reduced heat for about 5 minutes. A blend of cotton seed oil and emulsifier is added to the hot mixture with agitation. Pectin, gelatin, lemon juice, flavouring and crushed pineapple are then dispersed in the hot mixture with agitation and the mixture heated to 190°F. An aqueous solution of calcium chloride is added and the resulting mixture heated to 200°F.

A small quantity of the hot liquid gel-forming solution is introduced into a suitable container, after which the particulate material (ham, celery, almonds, cherries) is added. The remainder of the hot gel-forming solution, still in liquid form, is then added and the containers sealed and inverted. The sealed containers are subjected to a minimum heat processing step, that is, heating the containers at 210°F. - 212°F. for about 5 to 10 minutes so that the product attains a temperature of 185°F. for 3 minutes., to insure commercial sterility of the product and the containers are vigouously agitated and cooled. Upon cooling, the gel is solidified with the particulate matter distributed in a substantially uniform manner throughout the gel.

The resulting product, which has an overall pH of less than 4.5, is commercially sterile, with the particulate matter in the product retaining substantially its original taste, texture and appearance. Similar results are obtained when fish and/or seafood products such as crabmeat, lobster, etc. are used in the product.

Although the present invention has been described with reference to specific examples, it will be understood that changes, modifications and variations of composition and procedure may be made by those skilled in the art within the principle and scope of the appended claims. For example, while the invention has been described in conjunction with the use of normally low and medium acid meats, vegetables and cereal intended for human consumption, it will be understood that the process of the present invention may also be used in the preparation of foods intended for non-human consumption, such as animal foods. Also, while the term meat particles has been defined herein to refer to slices, cubes, shreds or other particle shapes of meat, poultry, fish and seafoods, it will be understood that cubes, shreds, etc. of cheese may also be acidified in the same manner to a pH of at least 4.5. Accordingly, references herein to meat particles will be understood to also include cheese particles. The product of this invention may be packaged in any suitable hermetically sealed container, including metal and glass containers, flexible packaging materials, and the like.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A process for canning particulate, normally low acid or medium acid foods to provide a commercially sterile product in which the taste, texture and appearance of the foods are substantially retained, which comprises

contacting a first group of normally low or medium acid food particles having a maximum thickness of about 1-1/4" selected from the group consisting of meat, poultry, fish, seafoods, cheese, and combinations thereof with an aqueous acidic solution having a temperature in the range of about 32°F to 160°F and a pH of between about 2.5 and 3.5 for a period of time sufficient to reduce the overall pH of the food particles to at least 4.5,

contacting a second group of normally low acid or medium acid food particles selected from the group consisting of fruits, vegetables, cereal products and combinations thereof with an acidic solution having a temperature of between about 180°F to 212°F and a pH of between about 2.5 and 3.5 to reduce the overall pH of said particles to at least about 5.0 within 15 minutes,

combining said first and second groups of food particles and contacting the food particles with an acidic liquid phase having a pH of below 4.5 and a temperature in the range of about 180°F and 212°F in a container so that the liquid phase surrounds all the food particles in the container and reduces the overall pH of the second group of food particles to at least 4.5,

sealing and inverting the container,

heating the food particles in the sealed container to a

Claim 1 continued ...

temperature of 185°F for 3 minutes or an equivalent time-temperature relationship, and

cooling the container.

2. The process defined in claim 1 in which the acidified particles of said first group of foods, at a temperature of between about 140°F - 160°F, and the acidified particles of said second group of foods, at a temperature of between about 150°F - 210°F, are combined in a container and contacted with the acidic liquid phase.

3. The process defined in claim 1 in which the acidic liquid phase contains gel forming ingredients, so that upon cooling a solidified gel is formed which surrounds all the food particles in the container.

4. The process defined in claim 1 in which the particles of said second group of foods are filled into containers within 5 minutes after removal from the hot acidic solution.

5. The process defined in claim 1 in which the said acidic liquid phase is a condiment-containing liquid.

6. The process defined in claim 1 in which said first and second groups of food particles are combined with the acidic liquid phase and are then filled into a container.

7. The canned, commercially sterile, particulate, acidified product produced according to the process of claim 1.

8. A process for canning particulate, normally low acid or medium acid foods to provide a commercially sterile product in which the taste, texture and appearance of the foods are substantially retained, which consists essentially of

Claim 8 continued ...

contacting a first group of normally low or medium acid food particles having a maximum thickness of about 1-1/4" selected from the group consisting of meat, poultry, fish, seafoods, cheese and combinations thereof with an aqueous acidic solution having a temperature in the range of about 32°F to 160°F and a pH of between about 2.5 and 3.5 for a period of time sufficient to reduce the overall pH of the food particles to at least 3.7,

contacting a second group of normally low acid or medium acid food particles selected from the group consisting of fruits, vegetables, cereal products and combinations thereof with an acidic solution having a temperature of between about 180°F to 212°F and a pH of between about 2.5 and 3.5 to reduce the overall pH of said particles to at least about 3.7 within 15 minutes,

combining said first and second groups of food particles and contacting the food particles with an acidic liquid phase having a pH of at least 3.7 and a temperature in the range of about 180°F to 212°F in a container so that the liquid phase surrounds all the food particles in the container whereby the overall pH of all the food particles in the container is no more than 3.7,

sealing and inverting the container, and

cooling the container to thereby provide a commercially sterile product.

9. The process defined in claim 8 in which the acidified particles of said first group of foods, at a temperature of between about 140°F - 160°F, and the acidified particles of said second group of foods, at a temperature of between about 150°F - 210°F, are combined in a container and contacted with the acidic liquid phase.

10. The process defined in claim 8 in which the acidic liquid phase contains gel forming ingredients, so that upon cooling, a solidified gel is formed which surrounds all the food particles in the container.

11. The process defined in claim 8 in which the particles of said second group of foods are filled into containers within 5 minutes after removal from the hot acidic solution.

12. The process defined in claim 8 in which the said acidic liquid phase is a condiment-containing liquid.

13. The process defined in claim 8 in which said first and second groups of food particles are combined with the acidic liquid phase and are then filled into a container.

14. The canned, commercially sterile, particulate, acidified product produced according to the porcess of claim 8.

15. A process for canning particulate, normally low acid or medium acid foods to provide a commercially sterile product in which the taste, texture and appearance of the foods are substantially retained, which consists essentially of

contacting a first group of normally low or medium acid food particles having a maximum thickness of about 1-1/4" selected from the group consisting of meat, poultry, fish, seafoods, cheese and combinations thereof with an aqueous acidic solution having a temperature in the range of about 32°F to 160°F and a pH of between about 2.5 and 3.5 for a period of time sufficient to reduce the overall pH of the food particles to at least 4.5, heating said first group of particles to a temperature above about 185°F,

contacting a second group of normally low acid or medium acid food particles selected from the group consisting of fruits, vegetables, cereal products and combinations thereof

Claim 15 continued ...
with an acidic solution having a temperature of between about 185°F to 212°F and a pH of between about 2.5 and 3.5 to reduce the overall pH of said particles to at least about 5.0 within 15 minutes and heat the said second group of particles to a temperature above about 185°F,

combining said first and second groups of food particles and contacting the food particles with an acidic liquid phase having a pH of below 4.5 and a temperature in the range of about 185°F to 212°F in a container so that the liquid phase surrounds all the food particles in the container and reduces the overall pH of the second group of food particles to at least 4.5, the food particles and the liquid phase being at a temperature of at least about 185°F when combined in the container,

sealing and inverting the container, and

cooling the container to thereby provide a commercially sterile product.

16. The process defined in claim 15 in which the acidic liquid phase contains gel forming ingredients, so that upon cooling a solidified gel is formed which surrounds all the food particles in the container.

17. The process defined in claim 15 in which the particles of said second group of foods are filled into containers within 5 minutes after removal from the hot acidic solution.

18. The process defined in claim 15 in which the said acidic liquid phase is a condiment-containing liquid.

19. The process defined in claim 15 in which said first and second groups of food particles are combined with the acidic liquid phase and are then filled into a container.

20. The canned, commercially sterile, particulate, acidified product produced according to the process of claim 15.